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Geochemistry and metamorphic evolution of a Ti–metagabbro in the Asnawa Group of the Shalair terrain (Sanandaj-Sirjan Zone), Kurdistan region, Iraq.

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Geochemistry and metamorphic evolution of a Ti–metagabbro in the Asnawa Group of the Shalair terrain (Sanandaj-Sirjan Zone), Kurdistan region, Iraq.

We present geochemical data, mineral chemistry, petrography, and theP-T conditions of a Ti–metagabbro from the Asnawa Group in the Shalair Terrain (Sanandaj-Sirjan Zone).Geochemical data indicate that this Ti–metagabbro has tholeiitic characteristics with low-K contents. Factor analyses of the elements indicate fractionation of common mineral phases such as clinopyroxene, hornblende, plagioclase, Ti-bearing phases (rutile, ilmenite, titanite), and apatite. The normal mid-oceanic ridge basalt (N-MORB)-normalized incompatible trace element diagram shows close similarity with typical N-MORB pattern. Tectonomagmatic discrimination diagrams suggest a dominating MORB environment. The rock/chondrite-normalized REE diagram of the amphibolites also shows their N-MORB-type signature, with relative enrichment in LREE. The rock derived from mixed primitive and depleted mantel.
The formation and preservation of the various metamorphic mineral assemblages and their mineral chemical characteristicsare strongly affected by the original magmatic whole-rock composition. This can be demonstrated by different microdomains, which contain different amphiboles and plagioclases.
The metamorphic history can be subdivided into the stages M1-M2-M3. The first stage of metamorphism was recorded by crystallisation of actinolite replacing clinopyroxene and igneous amphibole (M1 stage, 410< T < 490°C; 1.8 < P <2.2 kbar). Increase of temperature resulted in the formation of hornblende pseudomorphism and hornblende and sphene coronae growing on previous amphibole or clinopyroxene and ilmenite, respectively (M2 stage, 540 < T <580°C; 4.5 < P < 5.5 kbar). The third stage (M3 stage, 730 < T °C < 780°C; 6.5 < P < 7.5 kbar) led to the formation of a ferro-tschermakite corona, around the M2 amphibole, and rutile that developed on the sphene and ilmenite of M2, This as a result of continental collisional process, in Eocene between Arabian and Iranian plates.